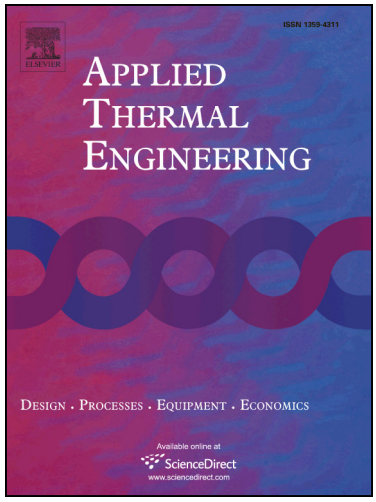

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3-D Analysis of Thermal-Mechanical Behavior of Wheel/Rail Sliding Contact Considering Temperature Characteristics of Materials

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Abstract: According to the actual geometry and sizes of rail and wheel, the thermo-mechanical coupling 3-D fine finite element model of wheel/rail contact was established by using ANSYS software. In the process, both the physical parameters of materials and friction coefficient between wheel and rail are seen as the functions of temperature. In this research, the 3-D characteristics of the sliding contact of wheel/rail were analyzed, including the following aspects: 1) the 3-D distribution characteristics of the temperature and strain of wheel and rail; 2) the contact patch and action zone on the rail surface under the condition of sliding etc.. The results of research show that the shape of the contact patch is similar to Hertz ellipse in the initial contact of wheel/rail, and the shape is more complex in sliding contact. The contact temperature on the wheel surface increases with time during wheel in sliding, reaches the maximum value at the end of sliding and is far greater than the temperature on rail surface. The results of 2-D and 3-D model show that the temperature of 2-D model is higher than that of 3-D model. The maximum value of plastic strain occurs on the surface and subsurface of contact region which may cause the rail surface to peel or scratch.

Keywords: Wheel/rail Sliding Contact; 3-D Finite Element Model; Temperature Characteristics of Materials; Contact Patch; Strain Field; Temperature Field.

1 Introduction

In recent years, railway transportation has been increasingly developed all over the world. The researches on wheel/rail relationship, suspension system and traction system provide powerful guarantee for the rapid development of railway science. It seems that railway transportation has met the requirements of railway transportation; however, there are many problems concerning the

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